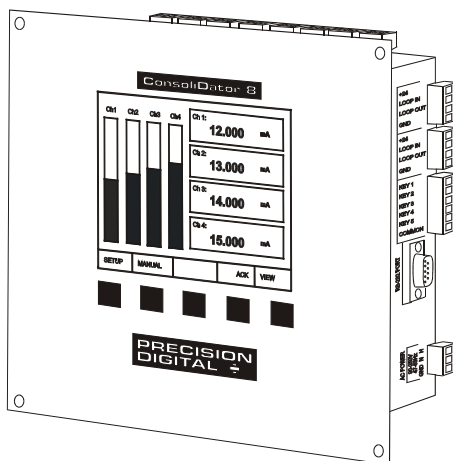
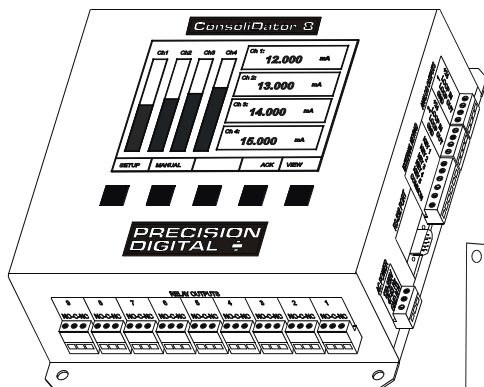


ConsoliDator™

Multi-Channel Controller

Instruction Manual



ConsoliDator 8 Features

- Eight 4-20 mA Inputs
- Eight 24 VDC @ 20 mA
- Two 4-20 mA Outputs

ConsoliDator 4 Features

- Four 4-20 mA Inputs
- Four 24 VDC @ 20 mA
- Four 4-20 mA Outputs

Common Features & Advantages

- Nine 10 A Relays
- Four Pulse Inputs
- Four Digital Inputs
- 90-264 VAC and 8-30 VDC Powered
- RS-232 Modbus® RTU Serial Communication
- Full Graphical 4.75" x 3.5" LCD with Backlight
- Intuitive Menus in English
- All Inputs & Outputs Factory Calibrated

PRECISION DIGITAL CORPORATION

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INTRODUCTION

The ConsoliDator is an easy to use multiple-channel controller. It accepts 4-20 mA inputs, flow meter pulse inputs, and digital inputs. It is equipped with multiple relays, which all have user-definable actions, 4-20 mA outputs, and Modbus protocol serial communication capabilities.

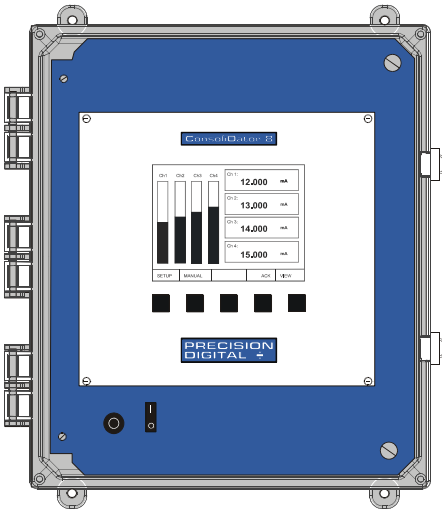
ORDERING INFORMATION

4-20 mA & Pulse Input Models

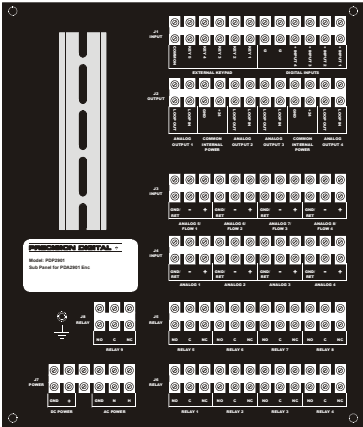
Model	Mounting	4-20 Inputs	Pulse Inputs	4-20 Outputs	Relays
PD980-8K9-15	Wall	8	4	2	9
PD981-8K9-15	Panel				
PD940-8K9-15	Wall	4	4	4	9
PD941-8K9-15	Panel				

Accessories

Model	Description
PDA2901	NEMA 4X (UL Type 4X) Enclosure for PD981 or PD941 models.
PDP2901	Sub Panel with Terminal Strips for PDA2901 Enclosure.
PDP2902	Low-Cost Sub Panel without Terminal Strips for PDA2901.
PDA6901	2" Pipe Mounting Kit for PDA2901 Enclosure.
PDX6901	Snubber .01μF, 470Ω, Flexible Leads.



PDA2901 optional enclosure features quick-release latches, a hinged front panel and internal space for mounting additional components such as relays and switches.



PDP2901 optional sub panel features terminal strips for convenient installation of all power, analog, and relay lines using up to 8 AWG wire.

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SPECIFICATIONS

Except where noted all specifications apply to operation at +25°C (77°F).

General

DISPLAY	Graphical: 4.75" x 3.5" (121 mm x 89 mm) LCD with backlight 320 X 240 pixels; Numerical: ±999999
DISPLAY UPDATE	2 seconds (0.5 Hz)
CALIBRATION	All ranges are calibrated at the factory.
PASSWORD	Programmable password restricts modification of programmed settings and use of manual control functions.
NON-VOLATILE MEMORY	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
POWER	AC: 90-264 VAC, 47 to 63 Hz, 20 VA DC: 8-30 VDC, 15 W
FUSE	AC: Unit is protected internally. 5 A max, slow blow, 250 V min UL Recognized external fuse recommended. DC: 5 A max, slow blow, 250 V (or 50 V min) UL Recognized external fuse recommended.
ISOLATION & GROUNDING	AC power is isolated from all inputs, outputs and relays to 1500 VAC. Isolation to 5000 VAC between analog inputs and analog outputs requires powering analog outputs with external supply. Signal and output power grounds are connected to earth (chassis) ground.
ENVIRONMENTAL	Operating temperature range: 0 to 50°C (32 to 122°F) Storage temperature range: -40 to 60°C (-40 to 140°F) Relative humidity: 0 to 90% non-condensing <i>*All functions operate down to -10°C (14°F). LCD response is slower below 0°C (32°F) and may need contrast adjustment to be readable.</i>
CONNECTIONS	Removable screw terminal blocks accept 12 to 24 AWG wire. DB9 male for serial connection.
TIGHTENING TORQUE	Screw terminal connectors: 4.5 lb-in (0.5 Nm)
ENCLOSURE	Type 1; Powder-coated steel; Color: warm gray
MOUNTING	Wall Mount (PD980 & PD940): four screws/bolts Panel Mount (PD981 & PD941): four screws/bolts Cutout: 7.37" x 8.35" (187 mm x 212 mm)
OVERALL DIMENSIONS	Wall Mount 8.75" x 8.00" x 3.00" (222 mm x 203 mm x 76 mm) (H x W x D) Panel Mount 8.66" x 9.36" x 3.10" (220 mm x 238 mm x 79 mm) (H x W x D)
WEIGHT	5.5 lb (2.5 kg)
WARRANTY	1 year parts and labor
EXTENDED WARRANTY	Warranty may be extended 1 year or 2 years. Contact factory for pricing and details.

4-20 mA Analog Inputs

ACCURACY	±0.03% of span ±1 count
TEMPERATURE DRIFT	50 PPM/°C from 0 to 50°C ambient
DECIMAL POINT	User selectable from zero to six places with automatic overflow.
INPUT RANGE	4-20 mA, Minimum span of 1 mA
INPUT IMPEDANCE	130 Ω , current limited
NORMAL MODE REJECTION	Greater than 100 dB at 50/60 Hz.
TRANSMITTER POWER SUPPLY	Each input is equipped with +24 VDC current limited. External supply may be substituted.
ENGINEERING UNITS	User selectable units or custom-entered units.

Flow Meter Pulse Inputs

SIGNAL RANGE	100 mVp-p to 15 Vp-p; 1 Hz to 10 kHz
CONVERSION FACTOR	Programmable from 0.00001 to 999999
DISPLAY OPTIONS	Rate and total values displayed on screen. Bargraphs user selectable to indicate either total or rate.
ENGINEERING UNITS	Show Total/Rate combinations as GAL & GPS, GAL & GPM, GAL & GPH, GAL & GPD, MG & MGD, BBL & BPH, BBL & BPD, LTR & LPD, LTR & LPH, LTR & LPS, CF & CFS, CF & CFM, CF & CFH, CF & CFD, MCF & MCD.
RATE & TOTAL DECIMAL POINT	Independent and user selectable from zero to six places with automatic overflow.
TOTALIZER	Calculates total based on rate. Reading stored in non-volatile memory every 5 minutes for power-loss recovery.
TOTALIZER RESET	Via front panel buttons (Password restricted).

Digital Inputs

INPUT TYPES	Normally open switch: External excitation not required. Open collector transistor: Open circuit voltage = 3 VDC Closed Circuit Current = 18.5 mA Switch closure or logic LO to terminals interpreted as "ON" LO = 0 to 1 VDC, HI = 2.5 to 12 VDC
INPUT IMPEDANCE	240 Ω
SIGNAL REQUIREMENTS	Minimum input pulse (closed contact or LO) duration: 1 sec Maximum input pulse frequency: 30 cycles per minute

Relays

RATING	SPDT (form C); rated 10 A @ 120/240 VAC or 5 A @ 28 VDC resistive load; 1/3 HP @ 120/240 VAC for inductive loads. Minimum load: 50 mA for AC, 10 mA @ 5 VDC
ISOLATION	1500 VAC between coil and contacts
DEADBAND	0-100% of full scale, user selectable
ELECTRICAL NOISE SUPPRESSION	An external suppressor (snubber) should be connected to each relay contact switching inductive loads, to prevent disruption to the microprocessor's operation. Recommended suppressor value: 0.01 μ F/470 Ω , 250 VAC (Order: PDX6901).
ASSIGNMENT & OPERATION	Any relay may be assigned to any analog or flow meter pulse input channel. Multiple relays may be assigned to the same channel. All relays are programmed independently. High or Low Alarm: Assign to analog or pulse channel for on/off relay control. Annunciator High or Low: Assign to analog or pulse channel for on/off relay control with reset capability from digital input switch. Summary Alarm: Use for indication of any relay entering alarm state. Supervisory Alarm: Use to indicate CPU failure or analog input signal loss. High or Low Pulse Action: Assign to analog or pulse input channel for pulsing on/off timed relay control. Programmable pulse width and delay. Trigger: Assign to pulse channel for indication of user-defined total increment. Programmable for scaled pulse output. Plunger Lift: Assign to analog and/or pulse channels to control a plunger lift system. Lead-Lag Alternation (Sequence): Link multiple relays for sequential operation. (Up to 9 relays). Programmable override set points to turn on up to 5 relays. Pulse Width Modulation: Assign to analog or pulse channel for on/off signal modulated based on input. User selectable cycle time. PI Control: Assign to analog or pulse channel for Proportional plus Integral on/off modulated duty cycle. Manual tuning required.
MANUAL OVERRIDE	Override any relay (Password restricted). Relays do not respond to input in this mode.
ACKNOWLEDGE	Front panel ACK key resets relays in <i>Supervisory</i> , <i>Summary</i> and <i>Annunciator Alarm Modes</i> .
TIME DELAY	Programmable on/off delays, 0-999.9 sec, independent for each relay
AUTO INITIALIZATION	When power is applied to the controller, relays will reflect the state of the input to the controller.

4-20 mA Transmitter Outputs

OUTPUT RANGE	4.00 to 20.00 mA
CALIBRATION	Factory calibrated for 4-20 mA
SCALING RANGE	Any process range.
ASSIGNMENT & OPERATION	Assign to any analog or pulse input channel for linear scaling or for manually tuned PID control output.
ACCURACY	$\pm 0.05\%$ F.S. ± 0.01 mA
TEMPERATURE DRIFT	50 PPM/ $^{\circ}$ C from 0 to 50 $^{\circ}$ C ambient. Output & Input drifts are separate.
OUTPUT LOOP POWER	Self powered or externally powered by 12 to 32 VDC
OUTPUT LOOP RESISTANCE	Powered by controller: 10 to 600 Ω Powered by external 12 VDC: 10 to 300 Ω Powered by external 24 VDC: 10 to 600 Ω Powered by external 32 VDC: 10 to 900 Ω

Modbus[®] Serial Communications

TYPE	RS-232 Modbus RTU
DEVICE ADDRESS	Programmable between 1 and 247
TRANSMIT TIME DELAY	Programmable between 0 and 300 ms
BAUD RATE	Programmable from 1200 to 38400
DATA	8 bit (1 start bit, 1 stop bit)
PARITY	EVEN or NONE. (NONE parity uses 2 stop bits).

Compliance Information

UL LISTED	USA and Canada UL 508 Industrial Control Equipment
UL FILE NUMBER	E160849

SAFETY INFORMATION



CAUTION: Read complete instructions prior to installation and operation of the controller.



WARNING: Risk of electric shock.



WARNING

Hazardous voltages present. Installation and service should be performed only by trained service personnel.

INSTALLATION

Unpacking

Remove the instrument from its box. Inspect the packaging and contents for damage. Report any damages to the carrier. If any part is missing or the controller malfunctions, please contact your supplier or the factory for assistance.

Wall Mounting

(For PD980 & PD940 Models)

- Obtain four #10 screws and nuts.
- Prepare four 1/4" holes through mounting surface spaced as shown.
- Allow at least two inches of free space on all sides so that the removable screw terminals and DB9 connector may be accessed for wiring.
- Secure instrument to surface.

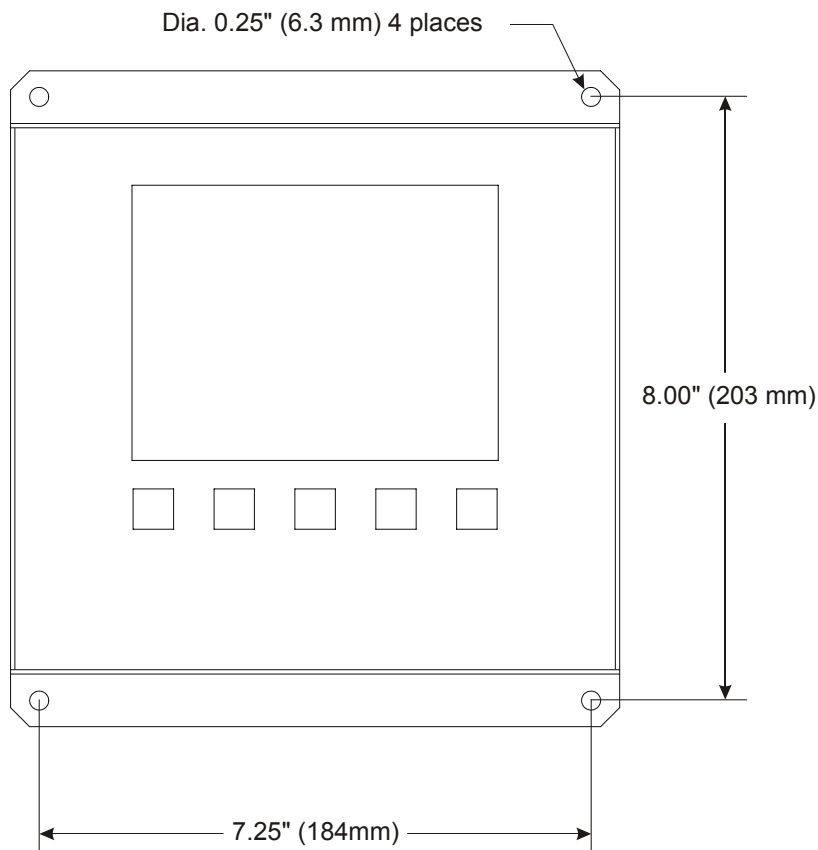


Figure 1. Wall Mount Dimensions (PD980 & PD940)

Panel Mounting

(For PD981 & PD941 Models)

- Obtain four #8 screws (M4.2) and nuts.
- Obtain four washers with at least 5/16" O.D. If the device will be subjected to vibration, lock washers are necessary.
- Prepare four 1/4" (6.3 mm) clearance holes through mounting surface spaced as shown.
- Prepare panel cutout.
 - 7.37" H x 8.35" W (187 mm x 212 mm)
 - Center cutout vertically and horizontally with respect to holes.
 - Maximum allowable inner radii: 0.1" (2.5 mm).
- Remove all connectors.
- Insert controller and secure to surface.

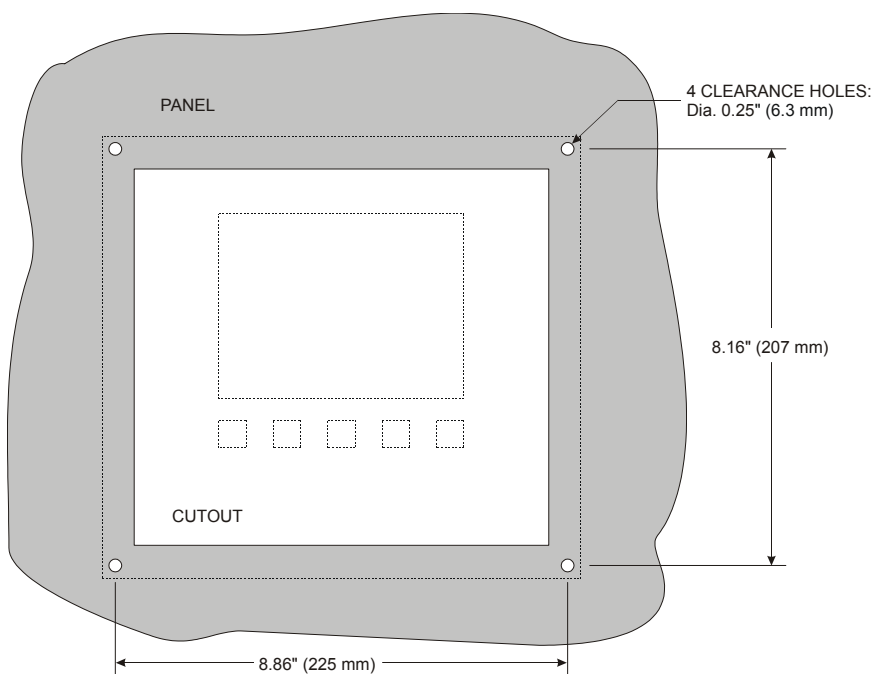


Figure 2. Panel Mount Dimensions (PD981 & PD941)

Connections

Connections are made to removable screw terminal connectors and a DB9 male serial connector. They are located around the sides of the controller.



Use copper wire with 60°C or 60/75°C insulation for all line voltage connections. Observe all safety regulations. Electrical wiring should be performed in accordance with all applicable national, state, and local codes to prevent damage to the instrument and ensure personnel safety.

Power Connections

Power connections are made to one of the power terminal connectors. All units are capable of being powered either by AC or by DC for the ranges specified.

CONNECT ONLY ONE OF THE POWER INPUTS

- **120-250 VAC Power (90 VAC min, 264 VAC max)**
 - Use three-terminal power connector as shown in Figure 3.
 - Unit is protected internally. 5 A max, slow blow, 250 V min UL Recognized external fuse recommended.
- **8-30 VDC Power**
 - Use two-terminal power connector as shown in Figure 3.
 - 5 A max, slow blow, 250 V (or 50 V min) UL Recognized external fuse recommended.

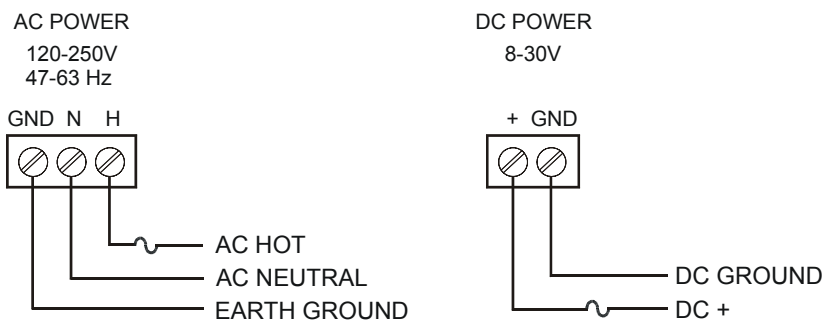


Figure 3. Power Connections

Input Signal Connections

Input signal connections are made to terminal connectors, which are labeled individually on the controller.

4-20 mA Analog Input Connections

Analog 4-20 Input connections are made to three-terminal connectors. The following figures show examples for typical applications. Each of the 4-20 mA inputs may be connected in any of the modes shown below.

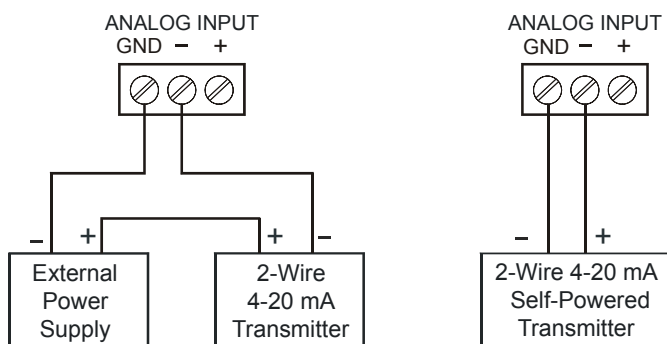


Figure 4. Transmitter Powered by Ext. Supply or Self-Powered

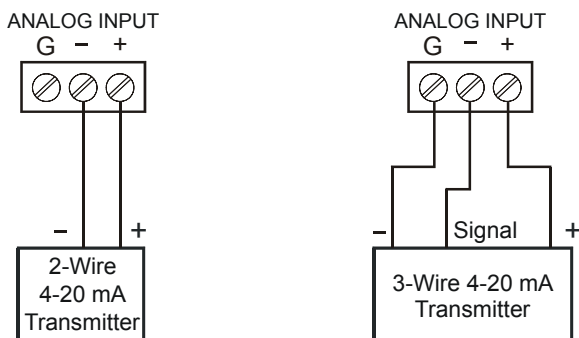


Figure 5. Transmitters Powered by ConsoliDator

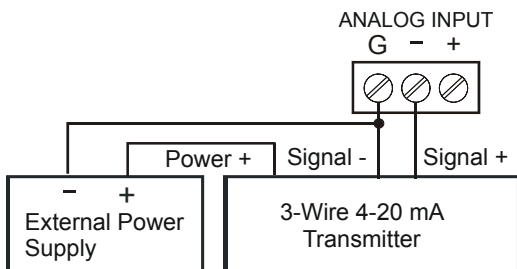


Figure 6. Three-Wire Transmitters Powered Externally

Flow Meter Pulse Input Connections

Flow Meter Pulse Inputs are wired to two-terminal connectors. A square waveform is used in the illustration, but the input is capable of reading many other types of signals within the voltage and frequency ranges specified.

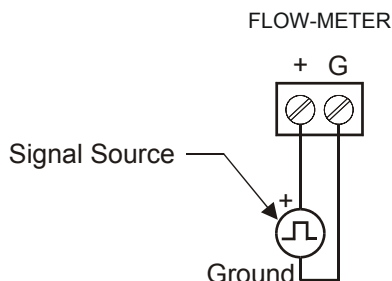


Figure 7. Flow Meter Pulse Input Connections

Digital Input Connections

Digital Inputs are wired to two-terminal connectors. Normally open switch contacts may be used as shown in Figure 8. Figure 9 shows a Digital Input using an NPN open collector transistor output from a live signal. Logic LO or switch closure appearing across the terminals is interpreted as ON. When using an open collector transistor, a logic HI at the base (marked "B" in Figure 9) will be interpreted as ON.

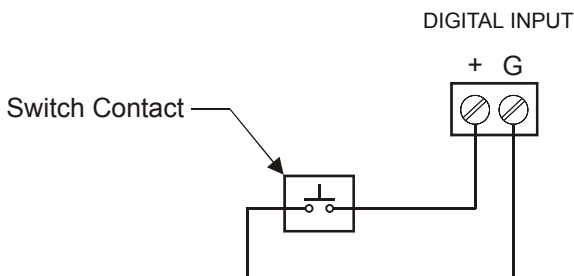


Figure 8. Digital Input From Switch Closure

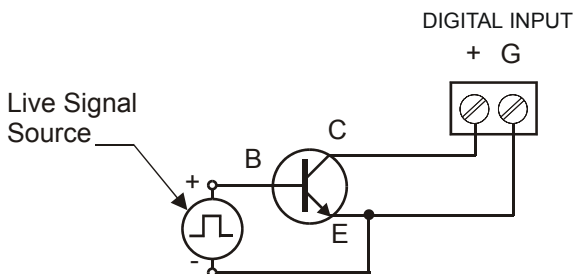


Figure 9. Digital Input From Live Signal

Analog Output Connections

The following figures show examples for 4-20 mA transmitter output connections. Terminal connectors are labeled individually on the side of the case. In order to obtain isolation from analog inputs, outputs must be powered from an external supply as shown in Figure 11.

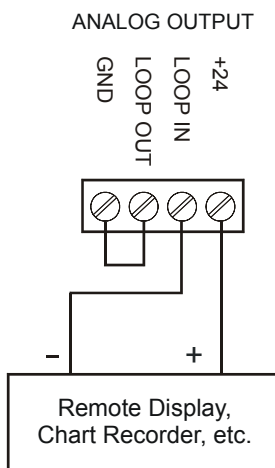


Figure 10. 4-20 mA Output Powered by ConsoliDator

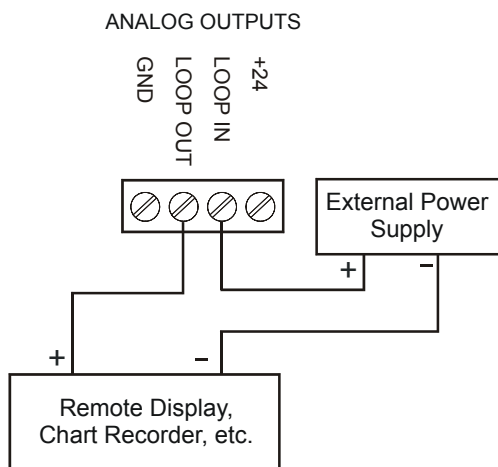


Figure 11. 4-20 mA Output Powered by External Supply

Relay Connections

Relay connections are made to three-terminal connectors labeled on the side of the case.

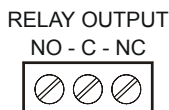


Figure 12. Relay Connections

Switching Inductive Loads

The use of suppressors (snubbers) is strongly recommended when switching inductive loads to prevent disrupting the microprocessor's operation. The suppressors also prolong the life of the relay contacts. Suppression can be obtained with resistor-capacitor (RC) networks assembled by the user or purchased as complete assemblies. Refer to the following circuits for RC network assembly and installation:

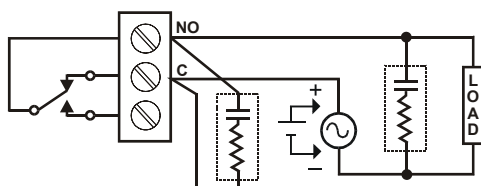


Figure 13. AC and DC Loads Protection

Choose R and C as follows:

R: 0.5 to 1 Ω for each volt across the contacts

C: 0.5 to 1 μF for each amp through closed contacts

Notes:

1. Use capacitors rated for 250 VAC.
2. RC networks may affect load release time of solenoid loads. Check to confirm proper operation.
3. Install the RC network at the instrument's relay screw terminals. An RC network may also be installed across the load. Experiment for best results.

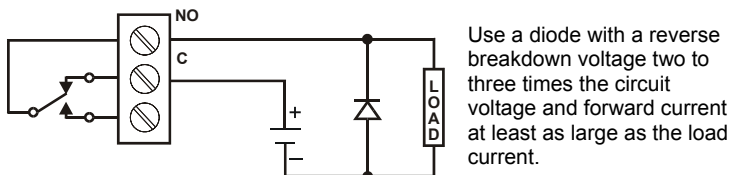


Figure 14. Low Voltage DC Loads Protection

RC Networks Available from Precision Digital

RC networks are available from Precision Digital and should be applied to each relay contact switching an inductive load. Part number: PDX6901.

Serial Communication Connections

A DB9 male connector is used for Modbus serial communication.

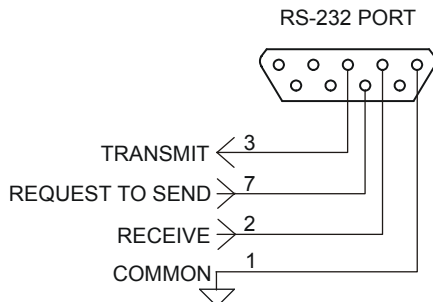


Figure 15. Serial Connections

External Keypad Connections

Normally open pushbuttons may be wired to the six-terminal external keypad connector when the front panel of the controller is not accessible. Keys 1 to 5 refer to the front buttons from left to right.

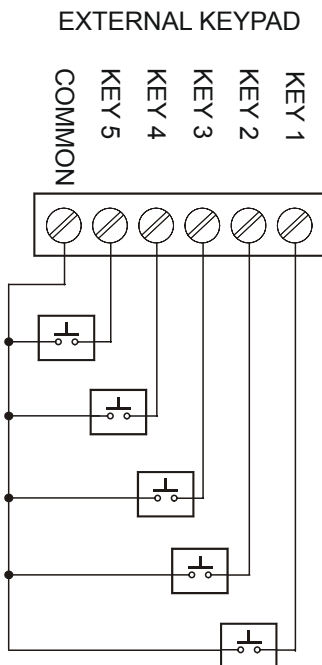


Figure 16. External Keypad Connections

NAVIGATING AND EDITING

The device displays various screens throughout programming and operation. Functions are programmed within their respective menu screens in many cases accompanied by user prompts.

Soft-Keys and Buttons

The unit is equipped with five buttons located below the display. The function of each button corresponds to its soft-key, which appears at the bottom of the display. Buttons assume different functions, which change according to the screen in view.



Selections are marked by a cursor, which appears on screen as an arrowhead. The keys below are used to navigate through menus and edit settings. Other special keys appear throughout the programming process.

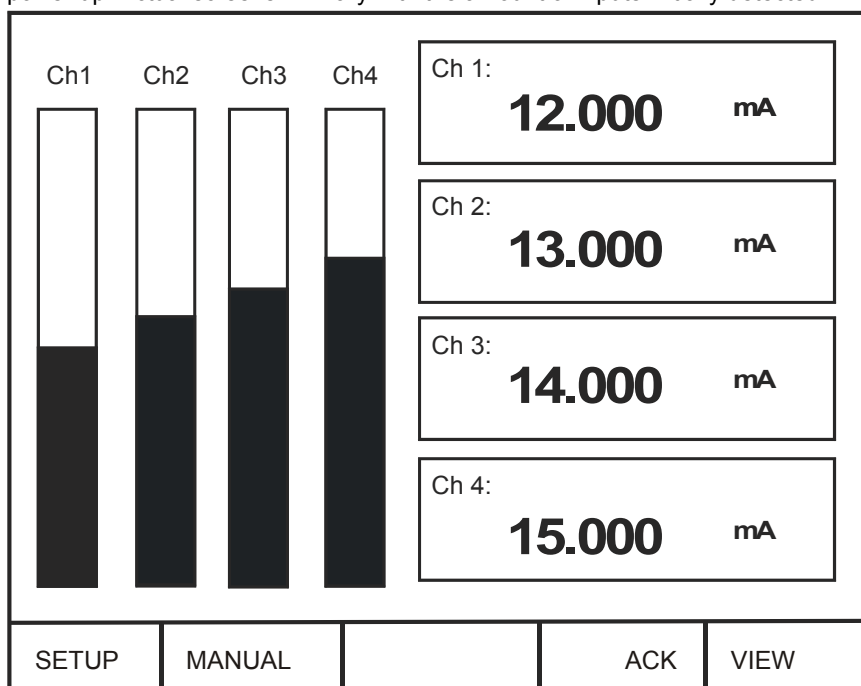
KEY	ACTION
ACK	Acknowledge relay(s)
EDIT	Modify selection
ENTER	Execute current selection
EXIT	Quit present screen or mode
MANUAL	Enter manual relay mode
RST	Reset total
SAVE	Store setting to memory
SETUP	Enter main setup menu
SIM	Enter simulation mode
VIEW	Scroll through operation screens
↑	- Move cursor up when navigating menus - Scroll up through characters & values when editing settings
↓	- Move cursor down when navigating menus - Scroll down through characters & values when editing settings
→	- Move cursor right when navigating menus - Move to next character space when editing settings
+	Increase setting
-	Decrease setting

SETUP AND PROGRAMMING

- There is **no need to recalibrate** the instrument when first received from the factory.
- The device is **factory calibrated** prior to shipment, for all input types. The calibration equipment is certified to NIST standards.

Overview

Setup and programming is done through the front buttons. After power and signal connections have been completed and verified, apply power to the instrument. Inputs, outputs, and relays are configured individually. It is recommended that all inputs be configured before outputs and relays are programmed. For information on general button functions, see **NAVIGATING AND EDITING** section on page 20. See page 43 for operation. Shown below is a typical screen that appears at power up. Actual screens will vary with the amount of inputs initially detected.



- The **SETUP** key is used to enter the setup menu (Password restricted).
- The **MANUAL** key is used to enter the manual relay override menu (Password restricted).
- The **ACK** key is used to acknowledge (reset) the relays assigned to *Supervisory*, *Summary* or *Annunciator Alarm* functions and to silence the buzzer.
- The **VIEW** key is used to scroll to the next operation screen.

Main Setup Menu

The main setup menu is the access point for setting up *Inputs*, *Outputs*, and *General Functions* during the programming process. The number of inputs and outputs shown on this screen are determined by the particular model.

- To access this menu from the operation screen: Press the **SETUP** key.

Inputs ▶ Channel #1 Channel #2 Channel #3 Channel #4 Channel #5 Channel #6 Channel #7 Channel #8 Flow Meter #1 Flow Meter #2 Flow Meter #3 Flow Meter #4	Outputs Alarm Relay #1 Alarm Relay #2 Alarm Relay #3 Alarm Relay #4 Alarm Relay #5 Alarm Relay #6 Alarm Relay #7 Alarm Relay #8 Alarm Relay #9 Analog Out #1 Analog Out #2			
General Functions Buzzer: ☒ ON OFF Change Password Save BL: ☒ YES NO Baud Rate: 19200 bps Parity: EVEN - 8E1 Modbus ID: 1 Tx Delay: 0 ms Adjust Contrast				
↓	↑	→	ENTER	EXIT

General Functions

General functions are accessible from the main setup menu.

Buzzer Settings

The buzzer will sound whenever a relay is active if [ON] is selected. To disable the buzzer, select [OFF].

Password Settings

Select *Change Password* to enter a new password up to ten characters in length or to change an existing password. A prompt will appear in a separate screen. After exiting setup the user will be prompted to enter the password before making any changes to the settings or operation. It is recommended to enter the password after the remainder of setup and programming has been completed. The password may be removed by leaving the *Enter New Password* box blank when changing it.

Backlight Settings

Selecting [YES] under *Save BL* automatically turns the backlight off if no buttons are pressed for five minutes. This is recommended unless it is necessary to have the backlight constantly on. When [NO] is selected, the backlight will remain on indefinitely.

Modbus Settings

Baud Rate: Select any available baud rate.

Parity: Select *EVEN – 8E1* for Even parity, 1 stop bit.

Select *NONE – 8N2* for None parity, 2 stop bits.

Select *NONE – 8N1* for None parity, 1 stop bit. (Included for special circumstances only).

Modbus ID: Specify an address.

Tx Delay: Specify a data transmission delay (response).

Contrast Settings

Select *Adjust Contrast* and press the **ADJ** key continuously to darken the display contrast. After the darkest possible setting is reached the **ADJ** key returns the display to its lightest setting. If the screen disappears due to light conditions, continue to press the **ADJ** key until it becomes visible.

Configuring 4-20 mA Inputs

The Analog Input menu is used to configure the 4-20 mA analog inputs. Each has a separate menu. All 4-20 mA inputs can be configured using the information provided in this section.

- To access *Analog Input* menu: Select a channel from the *Inputs* window in the main setup menu.

Analog Input: 1				
▶ Input Type: 4-20 mA Transmitter				
Channel ID: Analog: 1 mA:				
High Value: 16.00 mA 16.00				
Low Value: 4.00 mA 4.00				
Min Value: 0.00 mA				
Max Value: 20.00 mA				
Format: 9999.99 mA				
Units: mA				
↓	↑			EXIT

Analog Input Display Preferences

- | | |
|-------------------|---|
| <i>Channel ID</i> | Enter a name for the channel to appear on the operation screens and wherever else the channel is referenced. |
| <i>Format</i> | Select a position for the decimal point by shifting left or right (zero to five places). |
| <i>Units</i> | Select from any available engineering units or choose to enter a combination of characters by pressing the CUSTOM key. |
| <i>Max Value</i> | These values represent the input span and are used to determine the extents of the bargraphs. |
| <i>Min Value</i> | |

Scaling the 4-20 mA Input

High Value Upper process value corresponding to the high *mA* level, which appears to the right of the screen. The high *mA* level may be captured using a live signal source or entered manually if no signal source is present.

To set up high *mA* value using a live signal:

- Verify that a signal source is connected to the selected channel and transmitting the high process *mA* level (e.g. 20.00 *mA*).
- Position cursor in front of the high *mA* and press **LIVE** key.

Low Value Lower process value corresponding to the low *mA* level, which appears to the right of the screen. The low *mA* level may also be set up using a live signal source or entered manually if no signal source is present.

To set up low *mA* value using a live signal:

- Verify that a signal source is connected to the selected channel and transmitting the low process *mA* level (e.g. 4.00 *mA*).
- Position cursor in front of the low *mA* and press **LIVE** key.

*Note: Controller will not accept values for high and low *mA* if the minimum span of 1 *mA* is not met.*

Setting Flow Meter Pulse Inputs

The Flow Meter Input menu is used to configure a flow meter pulse input. All pulse input screens offer the same options as described in this section. Options are configured individually for each pulse input.

- To access *Flow Meter* menu: Select a Flow Meter input from the *Inputs* window in the main setup menu.

Flow Meter: 1

State:

Channel ID: Flow: 1 **ENABLED**

K Factor: 1000.00 pls / GAL

Max Value: 50.00 GPM

K-Fac Fmt: 9999.99 GPM

Rate Fmt: 9999.99 GPM

Total Fmt: 9999.99 GAL

Units: GAL & GPM

Display: RATE

↓

↑

EDIT

EXIT

Flow Meter Pulse Input Display Preferences

<i>Channel ID</i>	Enter a name for the channel, which appears on the operation screens, and wherever else the channel is referenced.
<i>Max Value</i>	Specify the rate or total maximum. When this level is reached, the channel's bargraph will appear completely filled.
<i>Rate Fmt:</i>	Select a position for the rate display decimal point by shifting left or right (zero to five places).
<i>Total Fmt</i>	Select a position for the total display decimal point by shifting left or right (zero to five places).
<i>Units</i>	Select from any available unit combinations for flow.
<i>Display</i>	Set to display [RATE] or [TOTAL] based bargraphs during operation. This entry also determines whether assigned relay actions (other than Trigger Relay) are linked to rate or total values. The picture on page 45 shows a typical screen when set to display total.

Flow Meter Pulse Input Configuration

<i>State</i>	Enable or disable the input by selecting [ENABLED] or [OFF]. If a certain flow meter input is not going to be used, [OFF] must be selected.
<i>K Factor</i>	Specify the conversion factor "K" in pulses per unit.
<i>K-Fac Fmt</i>	Select a position for the K Factor decimal point by shifting left or right (zero to five places).

Programming Relays

Each relay has an *Alarm Setup* menu used to program its functions. Functions are programmed individually for each relay except in the case of Lead-Lag mode. Each relay has the same available functions. All relays may be manually overridden. Before the relays are set up, verify that the inputs have been configured.

- To access *Alarm Setup* menu: Select a relay from the *Relays* window in the main setup menu.

Use *Alarm Mode* setting to assign relay action. When a mode is selected, relay menu options change accordingly. If the relay will not be used, [OFF] should be selected.

Supervisory or Summary Alarm Modes

- Select [Supervisory Alarm] from *Alarm Mode* options to turn relay on (energize) when a CPU failure is detected or if a process input is lost (no signal present).
- Select [Summary Alarm] from *Alarm Mode* options to turn relay on when any other relay enters alarm state.

High or Low Alarm Modes

High or Low functions are used to turn the relay on and off at selected process points. If it is necessary to have an external reset using a digital input channel or the **ACK** key select **Annunciator High or Low Alarm Modes** instead.

- Select [HIGH] from *Alarm Mode* options to turn relay on (energize) when high set point is reached and off when low reset point is reached.
- Select [LOW] from *Alarm Mode* options to turn relay on when low set point is reached and off when high reset point is reached.

Alarm Setup: 1				
▶ Alarm Mode: HIGH Channel: [1] Analog: 1 High Value: 16.00 mA Low Value: 8.00 mA Delay ON: 1.0 sec Delay OFF: 0.5 sec				
↓	↑		EDIT	EXIT

<i>Channel</i>	Assign the relay to any analog or pulse input.
<i>High Value</i>	Enter high process variable set/reset point.
<i>Low Value</i>	Enter low process variable set/reset point.
<i>Delay ON</i>	Enter the delay between when the set point is reached and the relay turns on (energizes).
<i>Delay OFF</i>	Enter the delay between when the reset point is reached and the relay turns off (de-energizes).

High or Low Pulse Alarm Modes

Pulse Modes are used to generate an on/off continuous pulsing signal.

- Select [HIGH: Pulse Mode] from *Alarm Mode* options to continuously pulse relay when high set point is reached. Pulsing stops when low reset point is reached.
- Select [LOW: Pulse Mode] from *Alarm Mode* options to continuously pulse relay when low set point is reached. Pulsing stops when high reset point is reached.

Alarm Setup: 1				
► Alarm Mode: HIGH: Pulse Mode Channel: [1] Analog: 1 High Value: 16.00 mA Low Value: 8.00 mA Delay ON: 1.0 sec Delay OFF: 0.5 sec P1. Width: 1.0 sec P1. Delay: 1.0 sec				
↓	↑		EDIT	EXIT

<i>High Value</i>	Enter high process variable set/reset point.
<i>Low Value</i>	Enter low process variable set/reset point.
<i>Delay ON</i>	Enter a delay between when the set point is reached and the pulse signal starts.
<i>Delay OFF</i>	Enter a delay between when the reset point is reached and the pulse signal stops.
<i>P1. Width</i>	Enter pulse duration (Energized relay).
<i>P1. Delay</i>	Enter duration between pulses (De-energized relay).

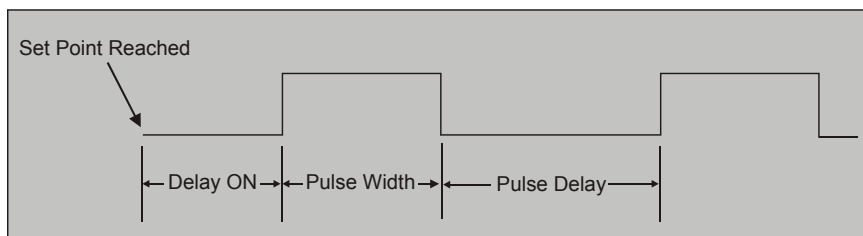


Figure 17. Pulse Relay Timing Diagram

Example Pulse Mode Scenario:

The unit is set to the following:

Alarm Mode: [HIGH: Pulse Mode]

High Value: [16 mA]

Low Value: [10 mA]

Delay ON: [2 sec]

Delay OFF: [3 sec]

Pl. Width: [1 sec]

Pl. Delay: [2.5 sec]

The following describes operation based on the above settings:

1. The process reaches 16 mA: 2 seconds pass with no relay action.
2. Relay begins pulsing: on for 1 second, off for 2.5 seconds. ON-OFF alternation continues while the process is above 10 mA.
3. The process reaches 10 mA: Pulse sequence continues for 3 seconds and then stops completely until 16 mA is reached again.

Trigger Alarm Mode

- Select Trigger mode to pulse the relay once each time the total from a flow meter pulse input channel is incremented by a certain value.

Alarm Setup: 1				
▶ Alarm Mode: Trigger				
Channel: [A] Flow: 1				
Set Point: 10.00 GAL				
P1 Width: 1.0 sec				
↓	↑		EDIT	EXIT

<i>Channel</i>	Assign the relay to any flow meter pulse input.
<i>Set Point</i>	Enter process variable set point. Each time the total increases by this value, the relay will be pulsed one time.
<i>P1. Width</i>	Enter duration for the relay to pulse on (energize).

Annunciator High or Low Alarm Modes

The Annunciator functions are similar to **High or Low Alarm Modes** except for the addition of a reset capability from the **ACK** key, a digital input channel (normally open pushbutton switch), or External Key 4.

- Select [ANNUNCIATOR: HIGH] from *Alarm Mode* options to turn relay on (energize) when high set point is reached and off when low reset point is reached.
- Select [ANNUNCIATOR: LOW] from *Alarm Mode* options to turn relay on when low set point is reached and off when high reset point is reached.

Alarm Setup: 1				
► Alarm Mode: ANNUNCIATOR: HIGH Channel: [A] Flow: 1 High Value: 16.00 GPM Low Value: 8.00 GPM Delay ON: 1.0 sec Delay OFF: 0.5 sec Reset Ch: [1] Reed SW: 1				
↓	↑		EDIT	EXIT

<i>Channel</i>	Assign the relay to any analog or pulse input.
<i>High Value</i>	Enter high process variable set/reset point.
<i>Low Value</i>	Enter low process variable set/reset point.
<i>Delay ON</i>	Enter the delay between when the set point is reached and the relay turns on (energizes).
<i>Delay OFF</i>	Enter the delay between when the reset point is reached and the relay turns off (de-energizes).
<i>Reset Ch</i>	Select a digital input channel to be used to reset the relay.

Plunger Lift by Differential Pressure Mode

- Select [PLUNGER LIFT: DP] from *Alarm Mode* options to operate a plunger lift system that monitors differential pressure.

Alarm Setup: 1				
▶ Alarm Mode: PLUNGER LIFT: DP				
Tubing Ch: [A] Flow: 1				
Casing Ch: [2] Analog: 2				
Switch Ch: [1] Reed SW: 1				
Set Point: 100.00 GPM				
Delay ON: 1.0 sec				
After Flow: 5 min				
↓	↑		EDIT	EXIT

<i>Tubing Ch</i>	Select a 4-20 mA input or pulse input (flow) as the tubing pressure or flow rate.
<i>Casing Ch</i>	Select a 4-20 mA input or pulse input (flow) as the casing pressure or flow rate.
<i>Switch Ch</i>	Select the channel that monitors a (pressure) switch input.
<i>Set Point</i>	Enter the process variable point at which the relay closes a valve. The point may either be differential pressure or flow from a turbine meter.
<i>Delay On</i>	Enter the time between when the set point is reached and the relay turns on (energizes).
<i>After Flow</i>	Enter a time long enough to guarantee that the plunger will fall to the bottom of the well.

Plunger Lift by Time Mode

- Select [PLUNGER LIFT: TIME] from *Alarm Mode* options to operate a plunger lift system based on time by specifying the on and off durations in the cycle.
- *This mode may also be used as a timer to cycle the relay on and off.*

Alarm Setup: 1				
▶ Alarm Mode: PLUNGER LIFT: TIME				
Rly On/Off: OFF				
Time ON: 1.0 min				
Time OFF: 5.0 min				
↓	↑		EDIT	EXIT

<i>Relay On/Off</i>	Select [ON] to enable relay function or [OFF] to disable.
<i>TIME ON:</i>	Enter relay-on duration.
<i>TIME OFF</i>	Enter relay-off duration.

Lead-Lag Modes (Pump Alternation Control)

Lead-Lag Modes are similar to **High or Low Alarm Modes** except up to nine relays may be linked to operate in sequence. This mode is commonly used for pump alternation control. For example: If relays #1, #2, and #3 are linked in this menu, relay #1 turns on the first time the set point is reached and off when the reset point is reached, relay #2 cycles the second time, and relay #3 cycles the third time. The sequence then repeats beginning with relay #1.

Note: Linked relays must be set to [OFF] in their respective menus. (i.e. If Alarm Setup 1 links Relay #2, Alarm Setup 2 must read "Alarm Mode: [OFF]")

- Select [LEAD-LAG: HIGH] from *Alarm Mode* options to turn relay on when high set point is reached and off when low reset point is reached.
- Select [LEAD-LAG: LOW] from *Alarm Mode* options to turn relay on when low set point is reached and off when high reset point is reached.

Alarm Setup: 1				
▶ Alarm Mode:		LEAD-LAG: HIGH		
Channel:		TANK 1		
High Value:		160.0 GAL		
Low Value:		8.0 GAL		
Delay ON:		1.0 sec		
Delay OFF:		0.5 sec		
Link Relays:				
ON: ■	1	2	3	4
■	5	6	7	8
■	9			

↓	↑		EDIT	EXIT
---	---	--	------	------

<i>Channel</i>	Assign the relay to any analog or pulse input.
<i>High Value</i>	Enter high process variable set/reset point.
<i>Low Value</i>	Enter low process variable set/reset point.
<i>Delay ON</i>	Enter the delay between when the set point is reached and the relay turns on (energizes).
<i>Delay OFF</i>	Enter the delay between when the reset point is reached and the relay turns off (de-energizes).
<i>Link Relays</i>	Select between two and nine relays to operate in sequence.

Lead-Lag Override Function

Lead-Lag mode supports an override function, which allows up to five linked relays to turn on if programmed points are reached. Override set points also operate in sequence. They are not assigned to particular relays.

- Use **OVER** key in Lead-Lag menu to access override menu.

Lead-Lag Override: 1			
► Over Type: Override 1 & 2 ON			
Set Pt. #1:		170.0 GAL	
Set Pt. #2:		180.0 GAL	

Over Type

Choose number relays to override main relay
(Up to 4 additional set points for a maximum
of 5 relays operating at once).

Set Pt. #1 (#2, #3, #4)

Specify each process set point for the override relays to activate.

Example:

[LEAD-LAG: HIGH] is used to link relays #1, #2, and #3. In the Alarm Menu, *High Value* is set at 160.0 GAL and *Low Value* is set at 8.0 GAL. In the Override Menu, *Over Type* is set to [Override 1 & 2 ON.] *Set Pt. #1* is set to 170.0 GAL and *Set Pt. #2* is set to 180.0 GAL.

When the input reaches 160.0 GAL, the first relay in the sequence (Relay #1) turns on. When 170.0 GAL is reached, the next relay (Relay #2) turns on. If at this point the input decreases and drops below 8.00 GAL, both relays will turn OFF simultaneously. If instead, the input reaches 180.0 GAL, the third relay will turn ON and all three will remain ON until 8.0 GAL has been reached.

Note: In most override applications the number of relays linked should equal the total number of set points. However, linking additional relays is allowed. In the example, if 5 relays were linked and the total set points remained at 3, it would only be possible for 3 of the 5 to be on at once, but all 5 would sequence.

Linear Pulse Width Modulation Mode

Linear PWM Mode is used to create an on/off pulse signal with a modulated duty cycle. In this mode the percentage of the relay cycle in which the relay is in the on state varies with relation to the process value. See Figure 18 for an example showing that the cycle time (period) remains the same, but the relay-on percentage of the cycle changes with the process value.

Note 1: Due to the life expectancy of mechanical relays, it is strongly recommended that cycle times be as long as possible (many minutes). Using a cycle time of less than a few minutes can wear out a relay and cause faulty operation.

Note 2: Relay is a constant OFF when process variable is at or below 10% of full span and a constant ON when process variable is at or above 90% of full span to prevent abrupt switching from occurring and causing damage to relays.

- Select [PWM: Linear] from *Alarm Mode* options to modulate the pulse relay signal in linear mode.

Alarm Setup: 1

▶ Alarm Mode: PWM: Linear

Channel: [A] Flow: 1

100% Value: 16.00 GPM

0% Value: 8.00 GPM

Cycle Time: 600 sec

↓

↑

EDIT

EXIT

<i>Channel</i>	Assign the relay to any analog or pulse input.
<i>100% Value</i>	Enter the process value at which the pulse width will be 100% of cycle.
<i>0% Value</i>	Enter the process value at which the pulse width will be 0% of cycle.
<i>Cycle Time</i>	Enter the period for 1 cycle (maximum 6550 sec).

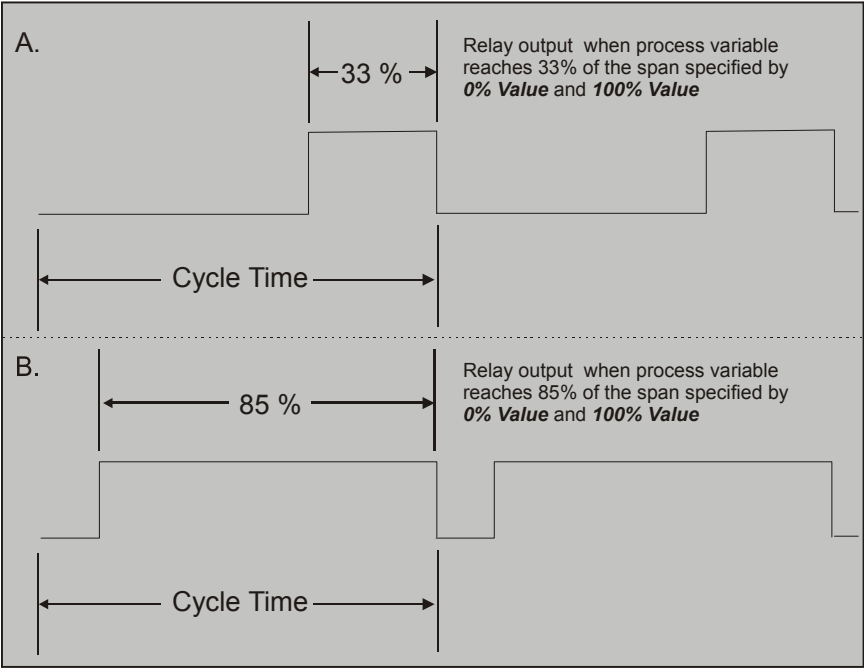


Figure 18. Linear PWM Relay Timing Example

Proportional Plus Integral Pulse Width Modulation Mode

PWM PI Control Mode is used to create an on/off pulse signal with a duty cycle modulated by the proportional integral settings. In this mode the percentage of the relay cycle in which the relay is in the on state varies with relation to the process value feedback and the PI settings.

Note: Due to the life expectancy of mechanical relays, it is strongly recommended that cycle times be as long as possible (many minutes). Using a cycle time of less than a few minutes can wear out a relay and cause faulty operation.

Alarm Setup: 1				
► Alarm Mode: PWM: PI Control Feedbk Ch: [A] Flow: 1 Set Point: 12.00 GPM Prop. Gain: 32.0 % Int. Time: 0.1 sec / rpt Cycle Time: 1 sec Rly Period: 600 sec Int. Limit: 1.0 % Inc / Dec: Increasing				
↓	↑		EDIT	EXIT

<i>Set Point</i>	Enter the process target.
<i>Feedbk Ch</i>	Select an analog input to supply the feedback signal from the system.
<i>Prop. Gain</i>	Enter the proportional gain expressed as a percentage.
<i>Int. Time</i>	Enter the integral time expressed as seconds per repeat.
<i>Cycle Time</i>	Enter the PI calculation cycle time (Low number for fast-responding systems, high number for slow-responding systems).
<i>Rly Period</i>	Enter a relay period.
<i>Int. Limit</i>	Specify the integration limit as a percentage (Limits integral influence on the output).
<i>Inc / Dec</i>	Select either [Increasing] or [Decreasing].

Setting 4-20 mA Outputs

The Analog Output menu is used to configure the 4-20 mA outputs. Each output has a separate screen. All 4-20 mA outputs can be configured using the information provided in this section.

- To access *Analog Output* menu: Select an analog output from the *Outputs* window in the main setup menu.

Linear Scaling of 4-20 mA Output

- Select [LINEAR] from *Mode* options to set the analog output for a linear scale from 4 to 20 mA.

Analog Output: 1 ► Mode: LINEAR Input Ch: [1] Analog: 1 4 mA Val: 10 gal 20 mA Val: 30 gal				
↓	↑		EDIT	EXIT

<i>Input Ch</i>	Assign the output to any 4-20 mA or pulse input. Note that more than one output can be scaled from the same input by simply choosing that channel in another Analog Output.
<i>4 mA Val</i>	Enter the low process level that will result in a 4 mA signal transmission.
<i>20 mA Val</i>	Enter the high process level that will result a 20 mA signal transmission.

Example:

If *4 mA Val* is set to 10 gal and *20 mA Val* is set to 30 gal, when the input reads 10 gal, 4 mA will be transmitted out. When the input reads 20 gal, 12 mA will be transmitted out, and when the input reads 30 gal, 20 mA will be transmitted out.

PID Control Using 4-20 mA Output

To set the analog output for PID control, select [PID CONTROL] from *Mode* options.

Analog Output: 1				
▶ Mode: PID CONTROL Set-point: 8.00 mA Feedbk Ch: [1] Analog: 1 Prop. Gain: 32.0 % Int. Time: 0.1 sec / rpt Deri. Time: 0.0 sec Cycle Time: 1.0 sec Int. Limit: 1.0 % Inc / Dec: Increasing				
↓	↑		EDIT	EXIT

<i>Set Point</i>	Enter the process target.
<i>Feedbk Ch</i>	Select an analog input to supply the feedback signal from the system.
<i>Prop. Gain</i>	Enter the proportional gain expressed as a percentage.
<i>Int. Time</i>	Enter the integral time expressed as seconds per repeat.
<i>Deri. Time</i>	Enter the derivative time in seconds.
<i>Cycle Time</i>	Enter the PID calculation cycle time (Low number for fast-responding systems, high number for slow-responding systems).
<i>Int. Limit</i>	Specify the integration limit as a percentage (Limits integral influence on the output).
<i>Inc / Dec</i>	Select either [Increasing] or [Decreasing].

OPERATION

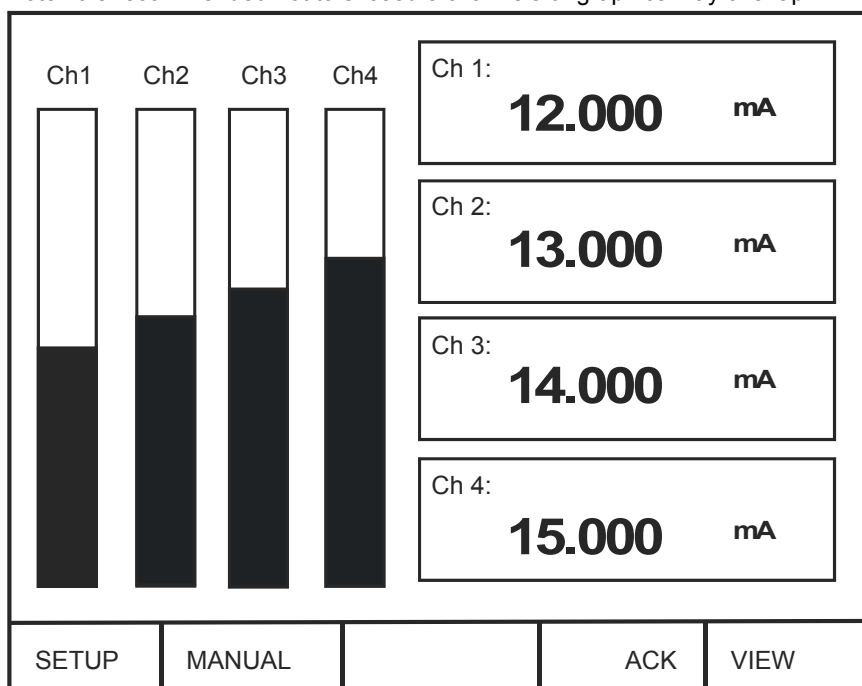
The instrument displays various screens showing bargraphs, numerical values, and relay status throughout operation. For information on general button functions, see **NAVIGATING AND EDITING** section on page 20.

- Press the **VIEW** key to scroll through multiple and individual channel operation screens.

Multiple Channel Operation Screen

Below is an example of what a multiple channel operation screen may look like for a four input application. The instrument will automatically detect the number of analog inputs connected and show all the corresponding bargraphs and values. If flow meter inputs have been configured and enabled, they will appear on this screen as well. Depending on the actual number of inputs in use, this screen will adjust its size and proportions automatically.

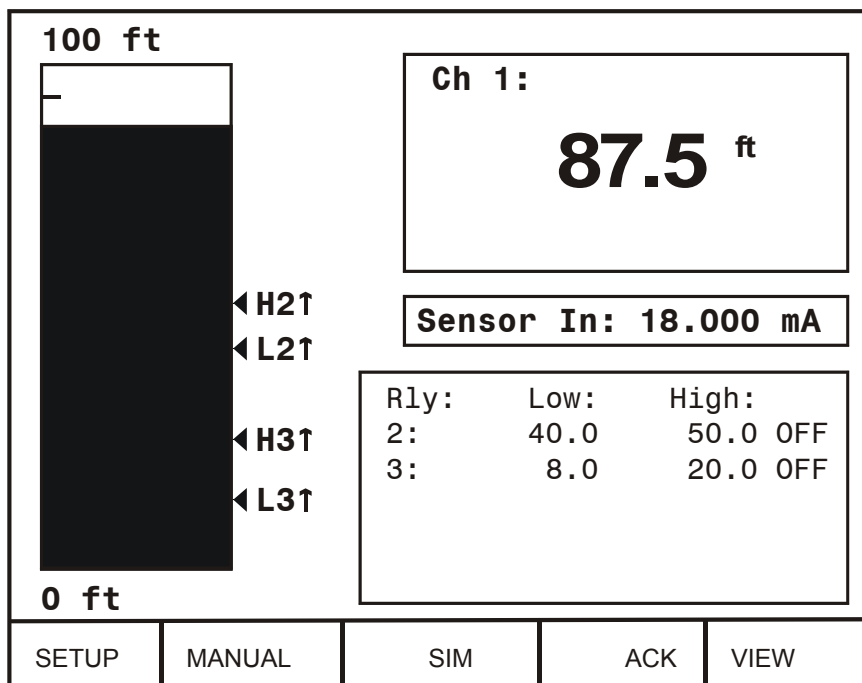
Note: It is recommended not to exceed 8 channels or graphics may overlap.



- The **SETUP** key is used to enter the setup menu (Password restricted).
- The **MANUAL** key is used to enter the manual relay override menu (Password restricted).
- The **ACK** key is used to acknowledge (reset) the relays assigned to *Supervisory*, *Summary* or *Annunciator Alarm* functions and to silence the buzzer.
- The **VIEW** key is used to scroll to the next operation screen.

Single Analog Input Operation Screen

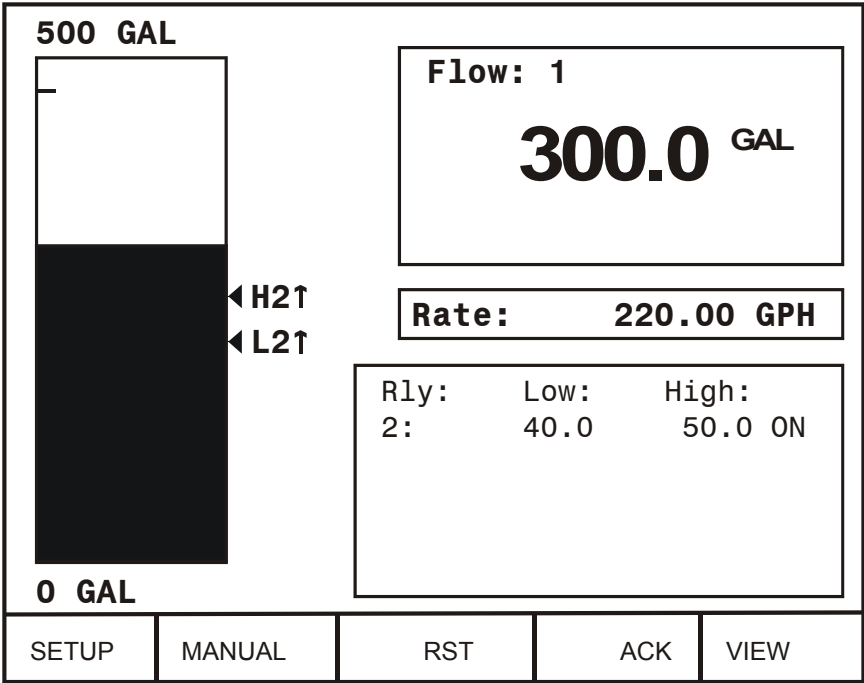
For each analog input channel, there is a detailed individual channel operation screen, which shows a bargraph with relay set points, numerical values, sensor input, and relay status for the relays assigned to that particular channel.



- The **SETUP** key is used to enter the setup menu (Password restricted).
- The **MANUAL** key is used to enter the manual relay override menu (Password restricted).
- The **SIM** key is used to enter simulation mode where the input can be simulated by adjusting it manually (Password restricted).
- The **ACK** key is used to acknowledge (reset) the relays assigned to *Supervisory, Summary or Annunciator Alarm* functions and to silence the buzzer.
- The **VIEW** key is used to scroll to the next operation screen.

Single Flow Meter Pulse Input Operation Screen

For each flow meter pulse input channel, there is a detailed individual channel operation screen, which shows a bargraph with relay set points, numerical values for rate and total, and relay status for the relays assigned to that particular channel. This screen may also be set to show a bargraph for rate rather than total. See Flow Meter Pulse Input Display Preferences section on page 27.



- The **SETUP** key is used to enter the setup menu (Password restricted).
- The **MANUAL** key is used to enter the manual relay override menu (Password restricted).
- The **RST** key is used to reset the total to zero (Password restricted).
- The **ACK** key is used to acknowledge (reset) the relays assigned to *Supervisory, Summary or Annunciator Alarm* functions and to silence the buzzer. Pressing **ACK** does not reset total.
- The **VIEW** key is used to scroll to the next operation screen.

Digital Input Operation Screen

The Digital Input screen shows the states of the digital inputs. *ON* is shown when a switch connected to the input is closed or when an open collector transistor is conducting. *OFF* is shown when the switch is open or when the open collector transistor is not conducting.

Digital Inputs	
Reed SW: 1	ON
Reed SW: 2	ON
Reed SW: 3	ON
Reed SW: 4	ON

SETUP	MANUAL		ACK	VIEW
-------	--------	--	-----	------

- The **SETUP** key is used to enter the setup menu (Password restricted).
- The **MANUAL** key is used to enter the manual relay override menu (Password restricted).
- The **ACK** key is used to acknowledge (reset) the relays assigned to *Supervisory*, *Summary* or *Annunciator Alarm* functions and to silence the buzzer.
- The **VIEW** key is used to scroll to the next operation screen.

Manual Relay Control

Use the *Manual Mode* menu to manually override relays by pressing **ON** or **OFF** keys while the relay is selected. The screen also displays the total time the relay has spent in the *ON* state and how many times the relay has cycled from *OFF* to *ON*. Hours and cycles may be returned to zero individually for each relay by pressing **RESET** while that relay is selected. If a password has been set, this menu is restricted.

- Access *Manual Mode* during operation by pressing the **MANUAL** key.

Note: All relays halt in their current state when key is pressed to enter manual mode and totalization continues. Relays do not respond to input changes in this mode.

Manual Mode				
		Hours	Cycles	
► Relay #1: ON		10.2	320	
Relay #2: OFF		215.0	566	
Relay #3: OFF		197.6	512	
Relay #4: ON		175.2	490	
Relay #5: OFF		121.7	251	
Relay #6: OFF		255.1	357	
Relay #7: ON		11.7	22	
Relay #8: ON		143.6	30	
Relay #9: OFF		412.5	197	
↓	↑	ON	RESET	EXIT

MODBUS[®] SERIAL COMMUNICATION

The controller is equipped with serial communication capability as a standard feature. The ConsoliDator can be connected to Data Circuit-Terminating Equipment (DCE) such as a radio transmitter with a regular straight-through serial cable. In other cases where connecting to Data Terminal Equipment (DTE), such as a PC, a NULL Modem cable and gender adapter may be necessary.

ConsoliDators support the following Modbus control functions:

Command	Name	Description
03	Read Holding Register	Read multiple bytes from holding registers.
06	Preset Single Register	Set single value into specified holding register.
16	Preset Multiple Registers	Set multiple values into specified holding registers.

Note: To save data to non-volatile memory after changing contents of holding register write 0xFFFF to address 40600.

Modbus Register Tables

Table 1. Analog Input Channels Register Addresses

Address (offset from 40000)								Description	Data Type
Ch. 1	Ch. 2	Ch. 3	Ch. 4	Ch. 5*	Ch. 6*	Ch. 7*	Ch. 8*		
1	33	65	97	129	161	193	225	Engineering Value	Floating Point
2	34	66	98	130	162	194	226		
3	35	67	99	131	163	195	227	Max. Graph Value	Floating Point
4	36	68	100	132	164	196	228		
5	37	69	101	133	165	197	229	Min. Graph Value	Floating Point
6	38	70	102	134	166	198	230		
7	39	71	103	135	167	199	231	High Value	Floating Point
8	40	72	104	136	168	200	232		
9	41	73	105	137	169	201	233	High Value mA	Floating Point
10	42	74	106	138	170	202	234		
11	43	75	107	139	171	203	235	Low Value	Floating Point
12	44	76	108	140	172	204	236		
13	45	77	109	141	173	205	237	Low Value mA	Floating Point
14	46	78	110	142	174	206	238		
15	47	79	111	143	175	207	239	Decimal Format	Byte
16	48	80	112	144	176	208	240	Ch. Online Flag	Byte
17	49	81	113	145	177	209	241	Ch. ID Char. 1	Byte
18	50	82	114	146	178	210	242	Ch. ID Char. 2	Byte
19	51	83	115	147	179	211	243	Ch. ID Char. 3	Byte
20	52	84	116	148	180	212	244	Ch. ID Char. 4	Byte
21	53	85	117	149	181	213	245	Ch. ID Char. 5	Byte
22	54	86	118	150	182	214	246	Ch. ID Char. 6	Byte
23	55	87	119	151	183	215	247	Ch. ID Char. 7	Byte
24	56	88	120	152	184	216	248	Ch. ID Char. 8	Byte
25	57	89	121	153	185	217	249	Ch. ID Char. 9	Byte
26	58	90	122	154	186	218	250	Ch. ID Char. 10	Byte
27	59	91	123	155	187	219	251	Units Character 1	Byte
28	60	92	124	156	188	220	252	Units Character 2	Byte
29	61	93	125	157	189	221	253	Units Character 3	Byte

*Channels 5-8 only apply to ConsoliDator 8 (PD980 & PD981) models.

Table 2. Flow Meter Pulse Input Channels Register Addresses

Address (offset from 40000)				Description	Data Type
Ch. 1	Ch. 2	Ch. 3	Ch. 4		
261	291	321	351	Flow Meter Rate	Floating Point
262	292	322	352		
263	293	323	353	Flow Meter Total	Floating Point
264	294	324	354		
265	295	325	355	K Factor	Floating Point
266	296	326	356		
267	297	327	357	Maximum Graph Value	Floating Point
268	298	328	358		
269	299	329	359	Flow Meter Previous Total	Floating Point
270	300	330	360		
271	301	331	361	Rate Decimal Format	Byte
272	302	332	362	Total Decimal Format – Upper 4 bits K Factor Decimal Format – Lower 4 bits	Byte
273	303	333	363	Ch. Online Flag	Byte
274	304	334	364	Display Format (Rate or Total)	Byte
275	305	335	365	Ch. ID Character 1	Byte
276	306	336	366	Ch. ID Character 2	Byte
277	307	337	367	Ch. ID Character 3	Byte
278	308	338	368	Ch. ID Character 4	Byte
279	309	339	369	Ch. ID Character 5	Byte
280	310	340	370	Ch. ID Character 6	Byte
281	311	341	371	Ch. ID Character 7	Byte
282	312	342	372	Ch. ID Character 8	Byte
283	313	343	373	Ch. ID Character 9	Byte
284	314	344	374	Ch. ID Character 10	Byte
285	315	345	375	Rate Units Character 1	Byte
286	316	346	376	Rate Units Character 2	Byte
287	317	347	377	Rate Units Character 3	Byte
288	318	348	378	Total Units Character 1	Byte
289	319	349	379	Total Units Character 2	Byte
290	320	350	380	Total Units Character 3	Byte

Table 3. Digital Input Channels Register Addresses

Address (offset from 40000)				Description	Data Type
Ch. 1	Ch. 2	Ch. 3	Ch. 4		
401	413	425	437	Digital State	Byte
402	414	426	438	Inversion State	Byte
403	415	427	439	Ch. ID Character 1	Byte
404	416	428	440	Ch. ID Character 2	Byte
405	417	429	441	Ch. ID Character 3	Byte
406	418	430	442	Ch. ID Character 4	Byte
407	419	431	443	Ch. ID Character 5	Byte
408	420	432	444	Ch. ID Character 6	Byte
409	421	433	445	Ch. ID Character 7	Byte
410	422	434	446	Ch. ID Character 8	Byte
411	423	435	447	Ch. ID Character 9	Byte
412	424	436	448	Ch. ID Character 10	Byte

Table 4. Relay Channels Register Addresses

Address (offset from 40000)									Description	Data Type
Rly. 1	Rly. 2	Rly. 3	Rly. 4	Rly. 5	Rly. 6	Rly. 7	Rly. 8	Rly. 9		
461	493	525	557	589	621	653	685	717	Alarm High Set point	Floating Pt.
462	494	526	558	590	622	654	686	718		
463	495	527	559	591	623	655	687	719	Alarm Low Set Point	Floating Pt.
464	496	528	560	592	624	656	688	720		
465	497	529	561	593	625	657	689	721	Alarm K Factor	Floating Pt.
466	498	530	562	594	626	658	690	722		
467	499	531	563	595	627	659	691	723	Alarm Diff-Pressure	Floating Pt.
468	500	532	564	596	628	660	692	724		
469	501	533	565	597	629	661	693	725	Relay ON Time	Floating Pt.
470	502	534	566	598	630	662	694	726		
471	503	535	567	599	631	663	695	727	Relay Cycles	Floating Pt.
472	504	536	568	600	632	664	696	728		
473	505	537	569	601	633	665	697	729	Delay On Time	Byte
474	506	538	570	602	634	666	698	730	Delay Off Time	Byte
475	507	539	571	603	635	667	699	731	Pulse On Time	Byte
476	508	540	572	604	636	668	700	732	Pulse Off Time	Byte
477	509	541	573	605	637	669	701	733	After Flow Time	Byte
478	510	542	574	606	638	670	702	734	Alarm Type	Byte
479	511	543	575	607	639	671	703	735	Alarm Ch.	Byte
480	512	544	576	608	640	672	704	736	Alarm Sec. Ch.	Byte
481	513	545	577	609	641	673	705	737	Alarm Dig. Ch.	Byte
482	514	546	578	610	642	674	706	738	Alarm ON/OFF Flag	Byte
483	515	547	579	611	643	675	707	739	Relay State Flag	Byte
484	516	548	580	612	644	676	708	740	Relay Assign Flag	Byte
485	517	549	581	613	645	677	709	741	Alarm PWM Output	Floating Pt.
486	518	550	582	614	646	678	710	742		
487	519	551	583	615	647	679	711	743	Alarm PID Set Pt.	Floating Pt.
488	520	552	584	616	648	680	712	744		
489	521	553	585	617	649	681	713	745	Alarm PID KP Setting	Integer
490	522	554	586	618	650	682	714	746	Alarm PID KI Setting	Integer
491	523	555	587	619	651	683	715	747	Alarm PID I Band	Integer
492	524	556	588	620	652	684	716	748	Alarm PID Direction	Byte

Table 5. Analog Output Channels Register Addresses

Address (offset from 40000)				Description	Data Type
Ch. 1	Ch. 2	Ch. 3*	Ch. 4*		
801	817	833	849	4 mA Value	Floating Point
802	818	834	850		
803	819	835	851	20 mA Value	Floating Point
804	820	836	852		
805	821	837	853	Set point Value	Floating Point
806	822	838	854		
807	823	839	855	PID Output Value	Floating Point
808	824	840	856		
809	825	841	857	Output Type	Byte
810	826	842	858	Input Ch.	Byte
811	827	843	859	PID KP	Integer
812	828	844	860	PID KI	Integer
813	829	845	861	PID KD	Integer
814	830	846	862	PID Cycle Time	Integer
815	831	847	863	PID I Band	Integer
816	832	848	864	PID Direction	Integer

*Channels 3-4 only apply to ConsoliDator 4 (PD940 & PD941) models.

Overall Dimensions

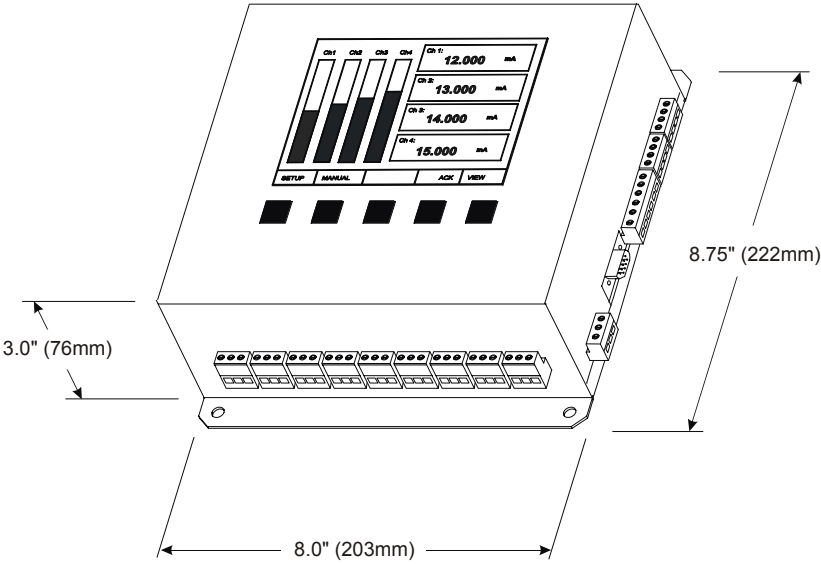


Figure 19. PD980 & PD940 Overall Dimensions

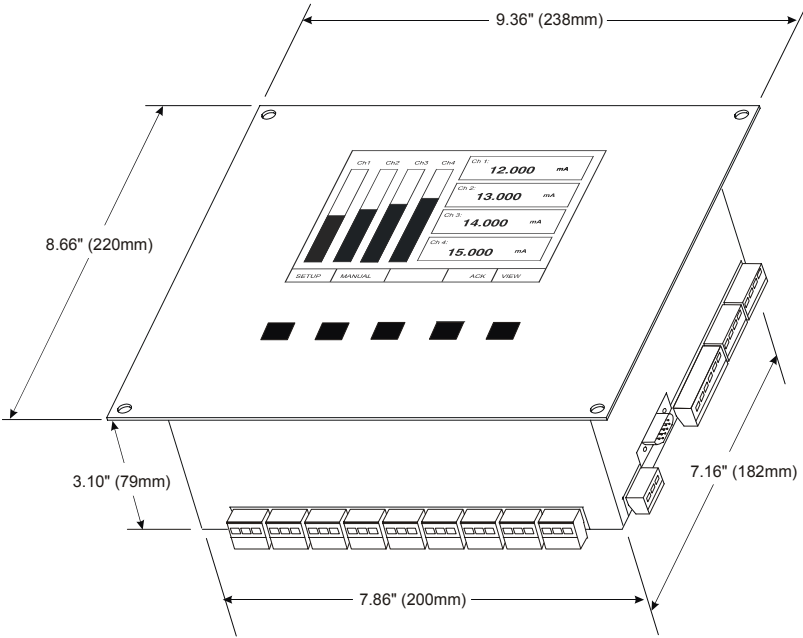


Figure 20. PD981 & PD941 Overall Dimensions

TROUBLESHOOTING TIPS

Symptom	Check/Action
No display, or only backlight is visible, but outputs still function normally	1. Contrast is too light: Adjust contrast in main setup menu. 2. Ambient temperature is below 0°C and affects LCD visibility: Adjust contrast to compensate. 3. High levels of radiated interference are present. Steps must be taken to shield controller from interference or to reduce interference present. Reference Switching Inductive Loads section on page 18.
"NO SENSORS FOUND" is displayed, but sensors are connected and transmitting	Allow controller to warm-up for 10 or more minutes. If sensors still not detected, cycle the power to reboot.
Display response seems slower than normal	Ambient temperature is too cold: Consider installing a heater with the instrument.
Display locks up or the instrument does not respond at all	Cycle the power to reboot the microprocessor.
Settings reprogrammed, but instrument behavior remains as previously programmed	Cycle the power to reboot the microprocessor.
Relay and status do not respond to signal	Check: 1. Relay action in <i>Setup</i> menu 2. Set and reset points
Other symptoms not described above	Call Technical Support for assistance.

Model: _____

Serial Number: _____

Password: _____

OTHER PRECISION DIGITAL PRODUCTS

Model	Description
PD118	MINIMUX® 8 Point Scanner
PD141AFO	VIGILANTE® four Point Annunciator with First-Out
PD602	Dart Low-Cost 1/8 DIN Process Meter
PD644	Javelin D Volt Meter 0-300 VDC
PD650	2.3" LED NEMA 4X Large Display Process Meter
PD655	1.0" LED NEMA 4X Large Display Process Meter
PD656	0.8" LED Exp-Proof Large Display Process Meter
PD660	Low-Cost NEMA 4X Loop Powered Meter
PD661	Low-Cost Explosion-Proof Loop Powered Meter
PD673	4½ Digit Loop Powered 1/8 DIN Meter
PD675	4½ Digit Loop Powered NEMA 4X Meter (FM & CSA)
PD680	3½ Digit Loop Powered 1/8 DIN Meter
PD685	3½ Digit Loop Powered NEMA 4X Meter
PD686	3½ Digit Loop Powered NEMA 4X Meter (FM or CSA)
PD687	3½ Digit Loop Powered Explosion-Proof Meter
PD690	1/8 DIN Universal Process Meter (UL Listed)
PD691	1/8 DIN Universal Strain Gauge Meter (UL Listed)
PD693	1/8 DIN Freq/Pulse Input Flow Totalizer (UL Listed)
PD694	1/8 DIN 0-200 DC Volt Meter (UL Listed)
PD696	1/8 DIN Loop Powered Flow Rate/Totalizer
PD697	NEMA 4X Loop Powered Flow Rate/Totalizer
PD698	Explosion-Proof Loop Powered Flow Rate/Totalizer
PD740	Javelin T Temperature Meter
PD750	1/8 DIN Universal Temperature Meter (UL Listed)
PD755	1.0" LED NEMA 4X Large Display Temperature Meter
PD756	0.8" LED Explosion-Proof Large Display Temperature Meter
PD757	2.3" LED NEMA 4X Large Display Temperature Meter
PD765	Trident Process & Temperature Meter (UL Listed)
PD865	Modbus® Snooper Serial Input Meter
PD540 Series	Digital Temperature Controllers
PD550 Series	Programmable Temperature Controllers
PD560 Series	Digital Temperature Meters
PD570 Series	Temperature Limit Controller

How to Contact Precision Digital

- For Technical Support please
call: (800) 610-5239
(508) 655-7300
fax: (508) 655-8990
e-mail: support@predig.com
- For Sales Support or to place an order please
call: (800) 343-1001
(508) 655-7300
fax: (508) 655-8990
e-mail: sales@predig.com
- For an online version of this Instruction Manual please visit
www.predig.com